2-WIRE E&M WITH A AND B LEADS (2WEM9A AND 2WEM6A) CHANNEL UNIT, 628130

GENERAL DESCRIPTION

CONTENTS PAGE

1. GENERAL 1
2. DESCRIPTION 1
3. FUNCTIONAL OPERATION (FIG. 2) 2
HYBRID 2
A AND B LEADS 2
TRANSMIT VF CIRCUIT 2
RECEIVE VF CIRCUIT 2
TRANSMIT SIGNALING 2
RECEIVE SIGNALING 4
CARRIER GROUP ALARM 4
BUSY MODE 4
4. OPTIONS 4
5. RESTRICTIONS 5
6. TEST AND MAINTENANCE FEATURES 5
7. TECHNICAL SUMMARY 5
8. REPLACEABLE PARTS 6
9. REFERENCES 7

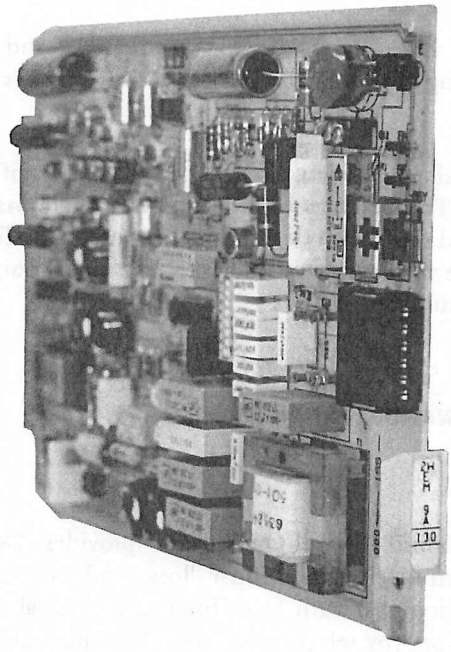

Fig. 1—2WEM9A and 2WEM6A Channel Unit, 628130

During system outages, the unit provides various disconnect/make-busy routines for the trunk. The unit provides a 900- or 600-ohm, 2-wire, 2-way E&M message circuit.

1. GENERAL

1.01 This Section provides a general description of the ITT D448 2-wire E&M with A and B leads (2WEM9A and 2WEM6A) channel unit, 628130 (Fig. 1), to the functional block diagram level.

1.02 This Section has been reissued to include information on the handling of CMOS-equipped units.

1.03 The unit provides a voice frequency (VF) and signaling interface between the central office (C.O.) equipment and the D448 multiplex terminal common equipment. In the transmit direction, the unit converts VF and M-lead signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the unit decodes received PCM into VF and E-lead signaling information.

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-440.

2.02 The unit is available in two groups. Group -0 provides 900-ohm plus 2.16-uF impedance matching. Group -1 provides 600-ohm plus 2.16-uF impedance matching. Group -0 is designated by the mnemonic 2WEM9A. Group -1 is designated by the mnemonic 2WEM6A.

2.03 The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf.

An identification strip on the handle face indicates the unit mnemonic (2WEM9A or 2WEM6A), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The E LED (DS1), the BSY switch (S5), and the splitting card jack (J1) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 2)

HYBRID

3.01 The hybrid is toll-grade and provides 28-dB (minimum) echo return loss and a 20-dB (minimum) singing return loss. Either the internal compromise network (by selecting DIP switch option [CN]) or an external precision balance network (PBN) may be used to balance the hybrid. Regardless of whether the internal compromise network or an external PBN is used, additional build-out capacitance may be paralleled across it by selecting DIP switch options [2] through [64]. Build-out capacitance from 0.002 to 0.126 uF in 0.002-uF steps may be selected. The NT and NR leads are brought out for connection to an external PBN. If an external PBN is used, the [CN] DIP switch should be opened (not selected).

A AND B LEADS

3.02 The A and B leads are used in interfacing certain types of switches and, in some instances, to return talk battery to the switch.

3.03 Issue 1 (-XX1) of the two available groups provides compatible capacitance for 4 uF, 1 uF, or zero capacitance (no capacitor) across trunk circuit A and B leads.

3.04 Issues 2 and 3 (-XX2 and -XX3) of the two available groups provide compatible capacitance for 4 uF, 3 uF, 2 uF, 1 uF, or zero capacitance (no capacitor) across trunk circuit A and B leads.

3.05 Refer to Section ITTR-18-440 for detailed option selection information.

TRANSMIT VF CIRCUIT

3.06 The incoming VF is transformer-coupled to the low-pass/high-pass filter where it is amplified and filtered. The gain applied to the input signal can be varied over a 3-dB range to compensate for VF input levels from 0 to -3.0 dBm (in 1-dB steps) by the selection of transmit (TX) prescription level DIP switch options [-1], [-2], or [-3]. The resulting signal is passed to the TX office wiring loss (OWL) compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal applied to the encoder to compensate for office wiring/cabling losses. The resultant range for input levels is 0 to -4.5 dBm in 0.1-dB steps.

3.07 The encoder converts the VF signal and signaling information (Para. 3.10 through 3.12) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

RECEIVE VF CIRCUIT

3.08 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.13 through 3.17).

3.09 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified. This amplification can be varied over a 6-dB range (in 1-dB increments) by the selection of RX prescription VF level DIP switch options [-1] through [-6]. This provides output levels of $+1.5$ to -6.0 dBm in 0.1-dB increments with both the OWL and prescription VF level options. The amplified VF is transformer-coupled to the C.O. equipment.

TRANSMIT SIGNALING

3.10 An idle condition is represented by presenting either ground or an open circuit to the M lead or an open from the M to the MB lead. This condition is applied to the TX signaling (SIG) interface circuit, which in turn applies this information to the encoder. However, the

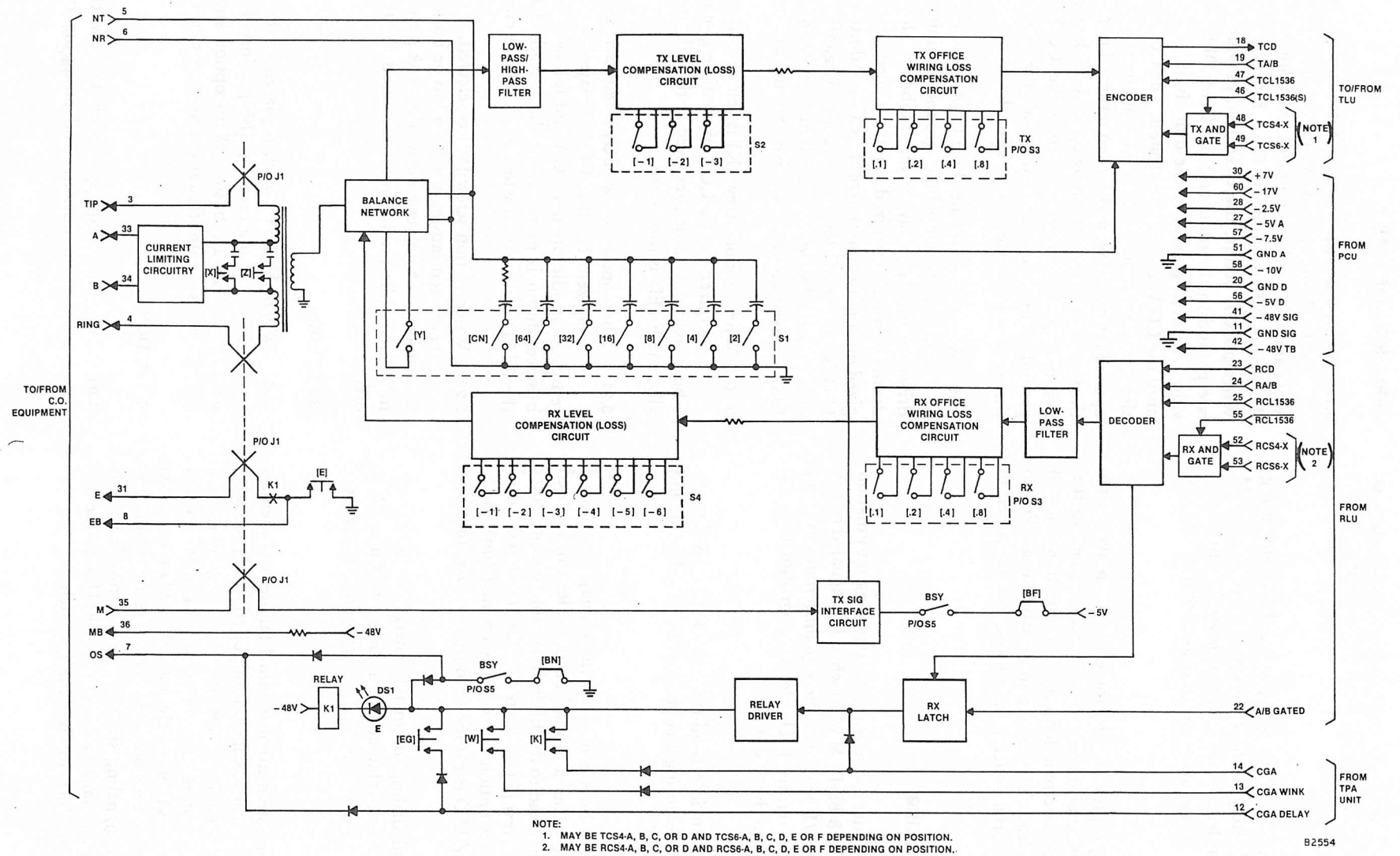

Fig. 2—2WEM9A and 2WEM6A Channel Unit, 628130, Functional Block Diagram

encoder will not process the information until it is signaled on the TA/B lead by the TLU that the signaling frame is upcoming.

3.11 A busy condition is represented by presenting either battery to the M lead or a loop from the M lead to the MB lead. This condition is applied to the TX SIG interface circuit and processed as described in Para. 3.10.

3.12 Dialing is presented by the C.O. equipment as an alternate ground (or open) battery applied to the M lead or as an alternate loop open-closure from the MB lead to the M lead. The dialing information is applied to the TX SIG interface circuit and processed as described in Para. 3.10.

RECEIVE SIGNALING

3.13 The decoder converts receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to the RX latch.

3.14 During an idle condition, the E relay is deenergized, presenting an open circuit at the E lead, and the E LED is off.

3.15 During a busy condition, the E relay is energized causing either a ground on the E lead or a closed loop from the E lead to the EB lead. A ground is presented when option screw [E] is selected, while the closed loop is presented when option screw [E] is opened (up). Additionally, the E LED is turned on during a busy condition.

3.16 Far-end dialing alternately energizes and deenergizes the E relay at the dialing rate which alternately conditions the E lead to reproduce the far-end dialing.

3.17 During intermittent terminal failures (momentary failures), the RX latch is inhibited from processing signaling information. This results in signaling state storage, which forces the unit to remain in its previous state (idle or busy) during the momentary failure to keep from dropping connections or to keep the unit from being accessed. The signaling state storage is controlled by the RLU. During a momentary failure, the RLU stops the A/B GATED signal which inhibits the RX latch.

CARRIER GROUP ALARM

3.18 During a system outage, three carrier group alarm (CGA) signals (CGA immediate ground, CGA wink, and CGA delay) and three CGA option screws ([K], [EG], and [W]) control the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit, and the CGA DELAY lead provides a delayed ground to the unit. Both grounds remain until the CGA condition is cleared. The CGA WINK lead also provides an immediate ground to the unit, but is opened after a delay, and is then returned to ground until the CGA is cleared. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received and when the wink pulse (open) occurs after the CGA.

3.19 When none of the three CGA options is selected, the CGA immediate ground inhibits the relay driver. With the relay driver inhibited, the E relay is deenergized, if energized, and is forced to stay deenergized during the duration of the CGA. Additionally, the E LED is turned off for the duration. Regardless of which options are selected, the OS lead is grounded when the CGA delayed ground is received by the unit.

3.20 When option screw [K] is selected, the E relay is energized by the CGA immediate ground causing a busy condition to be presented at the E lead. Additionally, the E LED is turned on.

3.21 When option screw [EG] is selected, the E relay is energized by the CGA delayed ground. This results in an idle upon a CGA and following the delay a busy condition is presented at the E lead. Additionally, the E LED is turned on when the E relay is energized.

3.22 When option screw [W] is selected, the E relay is energized causing the E lead to be busied immediately upon CGA. After a delay, the wink pulse provides a momentary idle condition to disconnect the trunk (wink-off).

BUSY MODE

3.23 When the BSY switch is placed in the BSY position, and option strap [BN] is installed, the OS lead and E lead are busied. With option strap [BF] installed, a busy is also forwarded to the far end.

4. OPTIONS

4.01 The unit is equipped with DIP switch options, screw-down options, and strapping options for

selecting circuit options. Refer to Section ITTR-18-440 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 for the physical location of these features.

TABLE A

FEATURE	REF. DES.	FUNCTION
E LED	DS1	Turns on when a busy condition is presented at the E lead.
BSY Switch	S5	When placed in BSY position, causes busy condition at E lead; with option strap [BF] installed, busy condition also sent to far end; with option strap [BN] installed, the OS lead is busied.
Splitting Card Jack	J1	Provides test/break jack access to C.O. equipment and channel unit drop sides of T and R leads.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

TABLE B

ITEM	SPECIFICATION
DC POWER	
Voltage	**Current Drain (nominal)**
−5V	19 mA
−10V	2.0 mA (at 5V)
+7V	5.0 mA (at 12V)
−17V	5.0 mA (at 12V)
−48V Signaling Battery	0 to 8.5 mA, depending upon signal conditions
−48V TB	1.5 mA
VF PERFORMANCE	
Impedance	
2WEM9A (628130-0)	900 ohms plus 2.16 uF
2WEM6A (628130-1)	600 ohms plus 2.16 uF
Levels	
Transmit	0 to −4.5 dBm, adjustable in 0.1-dB steps
Receive	+1.5 to −6.0 dBm, adjustable in 0.1-dB steps
Loss Stability (End-to End)	±0.5 dB over life in 95% of the circuits
Tracking (End-to-End)	
−37 to +3 dBm0 Input	0.5 dB maximum deviation
−50 to −37 dBm0 Input	1.0 dB maximum deviation
Idle Channel Noise (End-to-End)	23 dBrnc0 maximum
Signal-to-Distortion	
0 to −30 dBm0 Input	33 dB minimum overall; 35 dB minimum receive or transmit
−40 dBm0 Input	27 dB minimum overall; 29 dB minimum receive or transmit
−45 dBm0 Input	22 dB minimum overall; 25 dB minimum receive or transmit
Single Frequency Distortion (at 0 dBm0)	
Input Swept from 0 to 12 kHz	−28 dBm0 maximum at any other frequency

TABLE B (CONT)

ITEM	SPECIFICATION
Input between 1004 and 1020 Hz	– 40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better
Transhybrid Loss	
200 to 500 Hz	20 dB
500 to 1000 Hz	30 dB for 2WEM9A, 28 dB for 2WEM6A
1000 to 2500 Hz	35 dB for 2WEM9A, 30 dB for 2WEM6A
2500 to 3400 Hz	30 dB for 2WEM9A, 28 dB for 2WEM6A
Echo Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	28 dB minimum
Singing Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit)	20 dB minimum for 2WEM9A, 19 dB minimum for 2WEM6A
Frequency Response (2WEM9A) (Referenced to 1020 Hz, End-to-End)	
60 Hz	20.0 dB minimum loss
200 Hz	0 to – 5.0 dB
300 to 3000 Hz	+ 0.5 to – 1.0 dB
3200 Hz	+ 0.4 to – 1.5 dB
3400 Hz	0 to – 3.0 dB
Frequency Response (2WEM6A) (Referenced to 1000 Hz at 0 dBm0, End-to-End)	
600 to 2400 Hz	± 1.0 dB
300 to 3400 Hz	+ 1.0 to – 3.0 dB

TABLE B (CONT)

ITEM	SPECIFICATION
Balance Network	Compromise network of 900 or 600 ohms + 2.16 uF built-in and with BOC in 0.002-uF steps to 0.126 uF (NT and NR brought out for connection to external precision balance network)
Delay Distortion (End-to-End)	94 PAR (minimum)
Longitudinal Balance (AT&T Method)	
200 Hz	66 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
Longitudinal Balance (IEEE Method)	
200 Hz	60 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
SIGNALING	
Transmit	
Threshold Voltage (M lead)	Greater than – 20 Vdc with 1K ohm to M lead
Battery Signal (MB lead)	– 48 Vdc through 910 ohms
Pulsing Distortion	
Input	8 to 12 pps, 30 to 90% break
Output	± 2.0% maximum
OPERATING ENVIRONMENT	
Temperature	0 to + 55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Width	0.8 in. (1.9 cm)
Height	5.9 in. (15.0 cm)
Depth	9.7 in. (24.6 cm)
WEIGHT	1.1 lb (0.5 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

TYPE	DRAWING NO.
Assembly	628130-000
Schematic	628130-002

9.02 Related information on the 2WEM9A and 2WEM6A channel unit may be found in the ITTR Sections referenced in Table D.

TABLE D

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Trunk Channel Units — Option Selection and Installation	ITTR-18-440